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EXAMINER	
MOE, AUNG SOE	
ART UNIT	PAPER NUMBER
2612	7

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Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)
	09/326,422	NAYAR ET AL.
	Examiner	Art Unit
	Aung S. Moe	2612

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 June 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☐ Claim(s) *1-64* is/are pending in the application.

4a) Of the above claim(s) *15,16,22-34 and 54-64* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4,7,14,17-21,35,36 and 43-52* is/are rejected.

7)☒ Claim(s) *5,6,8-13,and 37-42* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Election/Restrictions

1. In response to the Office action mailed on April 8, 2033 (paper no. 4), the Applicant provisionally elect claims 1-63 and Group I of Figs. 1-12. However, It is noted that the Group I should be Species I of **Figs. 1-11A** as set forth in the previous Office Action (paper no. 4) and not Figs. 1-12 as stated by the Applicant in the response of paper no. 6 (i.e., noted that 35 U.S.C. § 121 required to elect **a single disclosed Species**; see **MPEP § 809.02(a)**). Furthermore, the instant application contains claims 1-64 and not 1-63 pending claims as stated in the response of paper no. 6.

In view of the above, the Applicant's response of paper no. 6 should read as follow: "applicants provisionally elect claims 1-64, which are within what has been identified as Group I, Figs. 1-11A. This election is made with traverse."

2. Applicant's election with traverse of Group I (Figs. 1-11A) and claims (1-63) set forth in Paper No. 6 (received on June 11, 2003) is acknowledged.

The traversal is on the ground(s) that the Office Action does not provide a prima facie basis for restricting the claimed subject matter, and it is respectfully submitted that no such basis exists". This is not found persuasive because it is noted that the most recent restriction requirement made was in the form of an election of **Species**, not a restriction requirement between more than one inventions. Moreover, the invention elected by the Applicant (i.e., Species I/Group I) is disclosed in the specification and drawing (i.e., Figs. 1-11A) as being embodied in multiple **patentably distinct embodiments** (i.e., noted that Figs. 12 and 22 are

directed to different type of imaging system arrangements. For example, all the elements found in the Figs. 12-12 and 22-23 are not necessary required for the Fig. 1-11A of the distinct embodiment; see MPEP § 806 and 806.04-806.04(h)). In view of this, the mere evidence of several <u>patentably distinct embodiments</u> is *prima facie* evidence of examining burdens of the Examiner.

Further, the Applicant stated that Figs. 1, 12 and 22 are identified as "exemplary embodiments of the present invention." In this regard, it is believed that at least independent claims 1 and 35 recite subject matter of sufficient scope to include each of these exemplary embodiments. Thus, when the claimed subject matter is considered, all 63 pending claims are properly considered together for purpose of search and examination."

In response, the Examiner respectfully disagrees because Figs. 1, 12 and 22 are in multiple patentably distinct embodiments. In fact, the invention of Species I (i.e., Figs. 1-11A) is patentably distinct embodiments because the invention of Species I (i.e., Figs. 1-11A) is mutually exclusive from either the invention of Species II or III. Further, independent claims 1 and 35 merely recite subject matter of species I (Figs. 1-11A) of one embodiment and particularly fails to show the specific features of either Species II (Figs. 12-21) or Species III (Figs. 22-24). For example, Species II (Figs. 12-21) specifically requires the use of a mask controller coupled to the image sensor as specified in claims 22-34 of the instant application and Species III (Figs. 22-24) specifically requires the use of photographic film for storing, processing, scanning and normalizing the pixel values from the scanner as recited in claims 60-64 respectively. In view of this, it is cleared that all the distinct features of either Species II or

Species III are not disclosed or clamed in the Species I (Figs. 1-11A), thus, all pending claims (1-64) are not applicable to the "species" (Figs. 1-11A) as identified by the Applicant.

The requirement is still deemed proper and is therefore made FINAL.

3. Claims 15-16, 22-34, 54, 55-59 and 60-64 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected Species of Figs. (12-24), there being no allowable generic or linking claim. Applicant timely traversed the restriction (election) requirement in Paper No. 6 (received 6/11/2003).

It is noted that claims 15-16 calls for a first lens system and a second lens system as shown in Species II (i.e., see Figs. 13, the lenses 162 and 163).

It is noted that claims 22-34 specifically require the use of a mask controller coupled to the image sensor as specified in Species II of Figs. 12-21.

It is noted that claim 54 specifically recites the use of a light diffuser (131) as specified in Species II of Figs. 12-21 (i.e., noted the light diffuser 131 as shown in Fig. 13).

It is noted that claim 55 specifically recites the use of a mask controller (183) for applying a respective exposure control signal to the mask (12/131) as specified in Species II of Figs. 12-21.

It is noted that claims 60-64 specifically require the use of photographic film for storing, processing, scanning and normalizing the pixel values from the scanner as recited in Species III of Figs. 22-24.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 4, 9-12, 41, and 49-50are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claim 4, it is unclear how "normalized pixel values" recited in line 2 of claim 4 is related to "normalized pixel values" recited in line 18 of claim 1? If there are the same "normalized pixel values", the Examiner suggests changing "normalized pixel values" in line 2 of claim 4 to - - said normalized pixel values - -.

Regarding claim 9, it is unclear how "normalized pixel values" recited in line 2 of claim 9 is related to "normalized pixel values" recited in line 18 of claim 1? If there are the same "normalized pixel values", the Examiner suggests changing "normalized pixel values" in line 2 of claim 9 to - - said normalized pixel values - -.

Regarding claim 12, it is unclear how "a saturated pixel values" and "a blackened pixel values" recited in lines 3-4 of claim 12 is related to "a saturated pixel value" and "a blackened pixel value" recited in lines 4 and 6 of claim 1? If there are the same "saturated pixel value" and "blackened pixel value", the Examiner suggests changing "a saturated pixel value" and "a blackened pixel value" in lines 3-4 of claim 12 to - - said saturated pixel value - - and - - said blackened pixel value - -.

Regarding claim 41, it is unclear how "a saturated pixel values" and "a blackened pixel values" recited in lines 3-4 of claim 41 is related to "a saturated pixel value" and "a blackened

pixel value" recited in lines 5 and 8 of claim 35? If there are the same "saturated pixel value" and "blackened pixel value", the Examiner suggests changing "a saturated pixel value" and "a blackened pixel value" in lines 3-4 of claim 41 to - - said saturated pixel value - - and - - said blackened pixel value - -.

Regarding claim 49, it is unclear how "normalized pixel values" recited in line 2 of claim 49 is related to "normalized pixel values" recited in lines 2-3 of claim 47? If there are the same "normalized pixel values", the Examiner suggests changing "normalized pixel values" in line 2 of claim 49 to - - said normalized pixel values - -.

Regarding claim 50, it is unclear how "a saturated pixel values" and "a blackened pixel values" recited in lines 3-4 of claim 50 is related to "a saturated pixel value" and "a blackened pixel value" recited in lines 5 and 7 of claim 44? If there are the same "saturated pixel value" and "blackened pixel value", the Examiner suggests changing "a saturated pixel value" and "a blackened pixel value" in lines 3-4 of claim 50 to - - said saturated pixel value - - and - - said blackened pixel value - -.

Specification

6. Applicant is reminded of the proper language and format for an abstract of the disclosure.

The abstract should be in narrative form and generally limited to a single paragraph on a separate sheet within the range of 50 to 150 words. It is important that the abstract not exceed 150 words in length since the space provided for the abstract on the computer tape used by the printer is limited. The form and legal phraseology often used in patent claims, such as "means" and "said," should be avoided. The abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details.

The language should be clear and concise and should not repeat information given in the title. It should avoid using phrases which can be implied, such as, "The disclosure concerns," "The disclosure defined by this invention," "The disclosure describes," etc.

7. The abstract of the disclosure is objected to because it is noted that the abstract is too long and exceeding the range of 50 to 150 words as discussed above, thus, the new abstract with the range of 50-150 words directing to the elected Species of Figs. 1-11A is required. Correction is required. See MPEP § 608.01(b).

8. The disclosure is objected to because of the following informalities: In page 26, lines 15 of the Specification the phrase "Memory 3 174" should be changed to - - Memory 174 - -.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

10. Claims 35-36, 43, 44 and 48 are rejected under 35 U.S.C. 102(e) as being anticipated by Mann (U.S. 5,828,793).

Regarding claim 35, Mann '793 discloses a system for high dynamic range imaging comprising: an image sensor (i.e., CCD sensor; col. 2, lines 40+) comprising an array of light-sensing elements (i.e., col. 12, lines 30+), the image sensor sensing an image of a scene and providing corresponding pixel values representing light intensities impinging on respective one of the light-sensing elements (i.e., as discussed and shown in Figs. 1-4, 7B and 8 that an image source 202 contains an array of light-sensing elements, e.g., CCD sensor, and further, providing a spatially varying exposure image; see col. 2, lines 40+), each light-sensing element having a respective first threshold level so as to cause the image sensor to provide a saturated pixel value when the intensity of light impinging on the light-sensing element is greater than the respective first threshold level (i.e., see Figs. 1-4 and 7B; noted from Fig. 1 that lighter image with a saturated pixel value is provide when the intensity of light impinging on the image sensor is greater than, e.g., above, a maximum density threshold level; see col. 4, line 50-col. 5, lines 1+; col. 6, lines 30+; col. 7, lines 20+ and col. 11, lines 30+), each light-sensing element having a

respective second threshold value so as to cause the image sensor to provide a blackened pixel value when the intensity of light impinging on the light-sensing element is below the respective second threshold level (i.e., noted from Fig. 1 that darker image with a blackened pixel value is provide when the intensity of light impinging on the image sensor is below a minimum density threshold level; see col. 4, lines 50 – col. 5, lines 1_; col. 6, lines 30+, col. 7, lines 20+ and col. 11, lines 30+), the image sensor having a low dynamic range relative to the range of light intensities of the image of the scene (i.e., as discussed in col. 2, lines 40+ and col. 3, lines 60+ that the object of Mann '793 is to expand the dynamic range of the source image scene, thus, the source image generated by the image sensor having a low dynamic range relative to the range of light intensities), the light-sensing elements having respective spatially varying photosensitivies to incident light and corresponding photosensitivity values indicative of the respective photosensitivities (i.e., noted the photosensitivity values indicative of the respective photosensitivities as shown in Figs. 1-4 and 7B; see col. 4, lines 45-col. 5, lines 48),

a first memory (i.e., Fig. 8, the element's 210; see col. 12, lines 35+) storing photosensitivity values corresponding to each of the light-sensing element; and

an image processor (i.e., Fig. 8, the elements' 220 and 240; see col. 12, lines 1+) coupled to the array of light-sensing elements for receiving the pixel values provided by the image sensor (i.e., noted the image source 202 having a CCD array sensor for providing the pixel values) and coupled to the first memory (i.e., Fig. 8, the element's 210) for receiving the photosensitivity values corresponding to the light-sensing elements (i.e., noted the photosensitivity values of the source image S1, S2 and S3, respectively), the image processor comprising a normalizer for mapping the pixel values by a function of photosensitivity values to

derive corresponding normalized pixel values (i.e., noted that the combiner 246 and the analyzer 243 is capable mapping the pixel values by a function of photosensitivity values to derive respective normalized pixel values; see col. 8, lines 5-10 and col. 12, lines 30+), and an interpolator for interpolating the normalized pixel values to derive interpolated pixel values at respective positions of a secondary array overlapping the array of light-sensing elements (i.e., noted that the filter 255 is capable of interpolating the normalized values respectively by overlapping the different array of pixels values of the source images; see Figs. 7A-7B; col. 10, lines 20+, col. 11, lines 5+ and col. 12, lines 30+).

Regarding claim 36, Mann '793 discloses wherein the normalizer of the image processor maps the pixel values by a function of the photosensitivity values by dividing each of the pixel values by the photosensitivity value corresponding to the light-sensing element receiving light intensity represented by the pixel value (i.e., see col. 7, lines 45 – col. 8, lines 20+).

Regarding claim 43, Mann '793 discloses an output image memory (i.e., Fig. 8, the elements 208 and 250) coupled to the image processor (i.e., Fig. 8, the elements' 220/210) for receiving and storing the interpolated pixel values.

Regarding claim 44, Mann '793 discloses a method for high dynamic range imaging comprising the steps of:

exposing an image sensor comprising an array of light-sensing elements to an image of a scene using a spatially varying exposure (i.e., as discussed and shown in Figs. 1-4 , 7B and 8 that an image source 202 contains an array of light-sensing elements, e.g., CCD sensor, and further, providing a spatially varying exposure image; see col. 2, lines 40+), the image sensor (i.e., the sensor of the image source 202) sensing the spatially varying exposure image and providing

corresponding pixel values representing light intensities impinging on respective one of the light-sensing elements (i.e., see Figs. 1-4 and 7B; col. 1, lines 15+, col. 2, lines 46+, col. 5, lines 1+ and col. 6, lines 25+), the image sensor (i.e., col. 2, lines 40+) providing a saturated pixel value when the intensity of light impinging on a corresponding one of the light-sensing elements is greater than a first threshold level (i.e., see Figs. 1-4 and 7B; noted from Fig. 1 that lighter image with a saturated pixel value is provide when the intensity of light impinging on the image sensor is greater than, e.g., above, a maximum density threshold level; see col. 4, line 50-col. 5, lines 1+; col. 6, lines 30+; col. 7, lines 20+ and col. 11, lines 30+) and providing a blackened pixel value when the intensity of the light impinging on a corresponding one of the light-sensing elements is below a second threshold level (i.e., noted from Fig. 1 that darker image with a blackened pixel value is provide when the intensity of light impinging on the image sensor is below a minimum density threshold level; see col. 4, lines 50 – col. 5, lines 1_; col. 6, lines 30+, col. 7, lines 20+ and col. 11, lines 30+), the image sensor having a low dynamic range relative to the range of light intensities of the image of the scene (i.e., as discussed in col. 2, lines 40+ and col. 3, lines 60+ that the object of Mann '793 is to expand the dynamic range of the source image scene, thus, the source image generated by the image sensor having a low dynamic range relative to the range of light intensities); and

normalizing the pixel value provided by the image sensor with respect to the spatially varying exposure of the light-sensing elements to derive corresponding normalized pixel values (i.e., see Figs. 1-7B; col. 7, lines 15-col. 8, lines 7+).

Regarding claim 48, Mann '793 discloses wherein the step of interpolating the normalized pixel values include the step of applying an interpolation filter (i.e., noted the filter 255 as

shown in Fig. 8) to the normalized pixel values (i.e., as discussed in col. 10, lines 20+ that the step of interpolating is applied to the normalized pixel values respectively; see Figs. 7A-7B).

11. Claims 44 and 51 are rejected under 35 U.S.C. 102(e) as being anticipated by Tatko et al. (U.S. 6,501,504).

Regarding claim 44, Tatko '504 discloses a method for high dynamic range imaging comprising the steps of:

exposing an image sensor comprising an array of light-sensing elements to an image of a scene using a spatially varying exposure (i.e., as discussed and shown in Figs. 1-6 that an image sensor 18 contains an array of light-sensing elements, e.g., CCD sensor, and further, providing a spatially varying exposure image; see col. 3, lines 4+), the image sensor (i.e., the sensor 18) sensing the spatially varying exposure image and providing corresponding pixel values representing light intensities impinging on respective one of the light-sensing elements (i.e., see Figs. 1 and 4-5; col. 1, lines 20+, col. 2, lines 4+, col. 3, lines 1+), the image sensor (i.e., the CCD 18) providing a saturated pixel value (i.e., High Gain value) when the intensity of light impinging on a corresponding one of the light-sensing elements is greater than a first threshold level (i.e., see Figs. 1-2A and 5; noted from Figs. 1/3A that lighter image with a saturated pixel value, e.g., the high gain value, is provide when the intensity of light impinging on the image sensor is greater than a first threshold level HTHR1; see col. 5, line 15+) and providing a blackened pixel value (i.e., Low Gain Value) when the intensity of the light impinging on a

corresponding one of the light-sensing elements is below a second threshold level (i.e., noted from Figs. 1/3A that darker image with a blackened pixel value, e.g., Low Gain Value, is provide when the intensity of light impinging on the image sensor is below a second threshold level HTHR2; see col. 5, lines 15+), the image sensor having a low dynamic range relative to the range of light intensities of the image of the scene (i.e., as discussed in col. 1, lines 60+ that the object of Tatko '504 is to enhance the dynamic range of the source image scene, thus, the source image generated by the image sensor 18 having a low dynamic range relative to the range of light intensities); and

normalizing (Fig. 1, the element 42) the pixel value provided by the image sensor with respect to the spatially varying exposure of the light-sensing elements to derive corresponding normalized pixel values (i.e., see Fig. 1; col. 5, lines 65+).

Regarding claim 51, Tatko '504 discloses the step of calibrating the pixel values provided by the image sensor (18) according to a response function of the image sensor to derive liner response pixel values (i.e., noted that the algorithm used by the combiner 32 is a linear combination wherein the composite image signals 40 is provided to the normalizer 42 for performing the normalization process; see col. 4, lines 25+) before the step of normalizing the pixel value (i.e., noted the normalizer 42).

Claim Rejections - 35 USC § 103

12. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

13. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

14. Claims 1-3, 7, 14, 17-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mann '793 in view of Roustaei (U.S. 2002/0050518A1).

Regarding claim 1, Mann '793 discloses a system for high dynamic range imaging comprising: an image sensor (i.e., CCD sensor; col. 2, lines 40+) comprising an array of light-sensing elements (i.e., col. 12, lines 30+), the image sensor sensing an image of a scene and providing corresponding pixel values representing light intensities impinging on respective one of the light-sensing elements (i.e., as discussed and shown in Figs. 1-4 , 7B and 8 that an image source 202 contains an array of light-sensing elements, e.g., CCD sensor, and further, providing a spatially varying exposure image; see col. 2, lines 40+), each light-sensing element having a respective first threshold level so as to cause the image sensor to provide a saturated pixel value when the intensity of light impinging on the light-sensing element is greater than the respective

first threshold level (i.e., see Figs. 1-4 and 7B; noted from Fig. 1 that lighter image with a saturated pixel value is provide when the intensity of light impinging on the image sensor is greater than, e.g., above, a maximum density threshold level; see col. 4, line 50-col. 5, lines 1+; col. 6, lines 30+; col. 7, lines 20+ and col. 11, lines 30+), each light-sensing element having a respective second threshold value so as to cause the image sensor to provide a blackened pixel value when the intensity of light impinging on the light-sensing element is below the respective second threshold level (i.e., noted from Fig. 1 that darker image with a blackened pixel value is provide when the intensity of light impinging on the image sensor is below a minimum density threshold level; see col. 4, lines 50 – col. 5, lines 1_; col. 6, lines 30+, col. 7, lines 20+ and col. 11, lines 30+), the image sensor having a low dynamic range relative to the range of light intensities of the image of the scene (i.e., as discussed in col. 2, lines 40+ and col. 3, lines 60+ that the object of Mann '793 is to expand the dynamic range of the source image scene, thus, the source image generated by the image sensor having a low dynamic range relative to the range of light intensities), a first memory (i.e., Fig. 8, the element's 210; see col. 12, lines 35+) storing photosensitivity values corresponding to each of the light-sensing element; and

an image processor (i.e., Fig. 8, the elements' 220 and 240; see col. 12, lines 1+) coupled to the array of light-sensing elements for receiving the pixel values provided thereby (i.e., noted the image source 202 having a CCD array sensor for providing the pixel values) and coupled to the first memory (i.e., Fig. 8, the element's 210) for receiving the photosensitivity values corresponding to the pixel value (i.e., noted the photosensitivity values of the source image S1, S2 and S3, respectively), the image processor comprising a normalizer for mapping the pixel values by a function of photosensitivity values to derive corresponding normalized pixel values

(i.e., noted that the combiner 246 and the analyzer 243 is capable mapping the pixel values by a function of photosensitivity values to derive respective normalized pixel values; see col. 8, lines 5-10 and col. 12, lines 30+).

Furthermore, although Mann '793 discloses the use of a mask for controlling the exposure of a sensor (i.e., see col. 13, lines 20+), Mann '793 does not explicitly states wherein "a mask interposed between the scene and the array of light-sensing elements of the image sensor, the mask having a multiplicity of light-transmitting cells each controlling the exposure of a respective one or more of the light-sensing elements to light from the scene, each of the light-sensing elements having a corresponding exposure value indicative of the transparency of the cell through which light impinging on the light-sensing element passes" as recited in present claimed invention.

However, the above-mentioned claimed limitations are well known in the art as evidenced by Roustaei '518. In particular, Roustaei '518 teaches the use of a mask with the light-sensing element (i.e., the CCD/MOS sensors as shown in Fig. 66-68) wherein the mask interposed between the scene and the array of light-sensing elements (i.e., see Figs. 66-68) of the image sensor (110), the mask having a multiplicity of light-transmitting cells each controlling the exposure of a respective one or more of the light-sensing elements to light from the scene, each of the light-sensing elements having a corresponding exposure value indicative of the transparency of the cell through which light impinging on the light-sensing element passes (i.e., as shown in Figs. 66-68, the respective one of the sensor 110 is exposed by the light which is controlled by the multiplicity of light-transmitting cells of the masks; see Page 19, Paragraph 0229+)" as recited in present claimed invention.

In view of the above, having the system of Mann '793 and then given the well-established teaching of Roustaei '518, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system of Mann '793 as taught by Roustaei '518, since Roustaei '518 state at page 1, paragraph 0008+ that such a modification would provide the best possible results with respect to resolution, signal-to-noise ratio, contrast and response.

Regarding claim 2, the combination of Mann '793 and Roustaei '518 discloses wherein the normalizer divides each of the pixel values with the exposure value corresponding to the light-sensing element receiving light intensity represented by the pixel value to derive corresponding normalized pixel values (i.e., col. 8, lines 5-10 of Mann '793)

Regarding claim 3, the combination of Mann '793 and Roustaei '518 discloses an interpolator for interpolating the normalized pixel values to derive interpolated pixel values at respective positions of a secondary array overlapping the array of light-sensing elements (i.e., noted from Figs. 8 of Mann '793 that the filter 255 is capable of interpolating the normalized values respectively by overlapping the different array of pixels values of the source images; see Figs. 7A-7B; col. 10, lines 20+, col. 11, lines 5+ and col. 12, lines 30+ of Mann '793).

Regarding claim 7, the combination of Mann '793 and Roustaei '518 discloses wherein the interpolator of the image processor applies an interpolation filter to the normalized pixel values (i.e., noted the filter 255 as shown in Fig. 8 of Mann '793; see col. 10, lines 20+ of Mann '793).

Regarding claim 14, the combination of Mann '793 and Roustaei '518 discloses an output image memory coupled to the image processor for receiving and storing the interpolated pixel values (i.e., noted the Storage 208 as shown in Fig. 8 of Mann '793).

Regarding claim 17, the combination of Mann '793 and Roustaei '518 discloses wherein the array of light sensing element is a solid state device image sensing device (i.e., see col. 2, lines 40+ of Mann '793; and page 1, paragraph 0003 of Roustaei '518).

Regarding claim 18, the combination of Mann '793 and Roustaei '518 discloses wherein the solid state device is a charge-couple device light sensing array (i.e., see col. 2, lines 40+ of Mann '793; and page 1, paragraph 0003 of Roustaei '518).

Regarding claim 19, the combination of Mann '793 and Roustaei '518 discloses wherein the solid state device is a CMOS light-sensing array (i.e., see paragraph 0003+ and 0236+ of Roustaei '518).

Regarding claim 20, the combination of Mann '793 and Roustaei '518 discloses wherein the mask is integrated with the light-sensing elements on the same substrate (i.e., see Figs. 68 and page 19, paragraphs 0233+ of Roustaei '518).

15. Claims 1 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mann '793 in view of Burger (U.S. 6,124,974).

Regarding claim 1, Mann '793 discloses a system for high dynamic range imaging comprising: an image sensor (i.e., CCD sensor; col. 2, lines 40+) comprising an array of light-sensing elements (i.e., col. 12, lines 30+), the image sensor sensing an image of a scene and providing corresponding pixel values representing light intensities impinging on respective one of the light-sensing elements (i.e., as discussed and shown in Figs. 1-4 , 7B and 8 that an image source 202 contains an array of light-sensing elements, e.g., CCD sensor, and further, providing a spatially varying exposure image; see col. 2, lines 40+), each light-sensing element having a

respective first threshold level so as to cause the image sensor to provide a saturated pixel value when the intensity of light impinging on the light-sensing element is greater than the respective first threshold level (i.e., see Figs. 1-4 and 7B; noted from Fig. 1 that lighter image with a saturated pixel value is provide when the intensity of light impinging on the image sensor is greater than, e.g., above, a maximum density threshold level; see col. 4, line 50-col. 5, lines 1+; col. 6, lines 30+; col. 7, lines 20+ and col. 11, lines 30+), each light-sensing element having a respective second threshold value so as to cause the image sensor to provide a blackened pixel value when the intensity of light impinging on the light-sensing element is below the respective second threshold level (i.e., noted from Fig. 1 that darker image with a blackened pixel value is provide when the intensity of light impinging on the image sensor is below a minimum density threshold level; see col. 4, lines 50 – col. 5, lines 1_; col. 6, lines 30+, col. 7, lines 20+ and col. 11, lines 30+), the image sensor having a low dynamic range relative to the range of light intensities of the image of the scene (i.e., as discussed in col. 2, lines 40+ and col. 3, lines 60+ that the object of Mann '793 is to expand the dynamic range of the source image scene, thus, the source image generated by the image sensor having a low dynamic range relative to the range of light intensities), a first memory (i.e., Fig. 8, the element's 210; see col. 12, lines 35+) storing photosensitivity values corresponding to each of the light-sensing element; and

an image processor (i.e., Fig. 8, the elements' 220 and 240; see col. 12, lines 1+) coupled to the array of light-sensing elements for receiving the pixel values provided thereby (i.e., noted the image source 202 having a CCD array sensor for providing the pixel values) and coupled to the first memory (i.e., Fig. 8, the element's 210) for receiving the photosensitivity values corresponding to the pixel value (i.e., noted the photosensitivity values of the source image S1,

S2 and S3, respectively), the image processor comprising a normalizer for mapping the pixel values by a function of photosensitivity values to derive corresponding normalized pixel values (i.e., noted that the combiner 246 and the analyzer 243 is capable mapping the pixel values by a function of photosensitivity values to derive respective normalized pixel values; see col. 8, lines 5-10 and col. 12, lines 30+).

Furthermore, although Mann '793 discloses the use of a mask for controlling the exposure of a sensor (i.e., see col. 13, lines 20+), Mann '793 does not explicitly states wherein "a mask interposed between the scene and the array of light-sensing elements of the image sensor, the mask having a multiplicity of light-transmitting cells each controlling the exposure of a respective one or more of the light-sensing elements to light from the scene, each of the light-sensing elements having a corresponding exposure value indicative of the transparency of the cell through which light impinging on the light-sensing element passes" as recited in present claimed invention.

However, the above-mentioned claimed limitations are well known in the art as evidenced by Burger '974. In particular, Burger '974 teaches the use of a mask with the light-sensing element (Figs. 2, 16A and 18-19; col. 20, lines 5+ and col. 27, lines 45+) wherein the mask interposed between the scene and the array of light-sensing elements (i.e., see Figs. 2, 16A, 18-22 and 27) of the image sensor (i.e., the CCD sensor), the mask having a multiplicity of light-transmitting cells each controlling the exposure of a respective one or more of the light-sensing elements to light from the scene, each of the light-sensing elements having a corresponding exposure value indicative of the transparency of the cell through which light impinging on the light-sensing element passes (i.e., as shown in Figs. 16A, 18-19, the respective one of the sensor

is exposed by the light which is controlled by the multiplicity of light-transmitting cells of the masks; see col. 27, lines 5-col. 28, lines 20+) as recited in present claimed invention.

In view of the above, having the system of Mann '793 and then given the well-established teaching of Burger '974, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system of Mann '793 as taught by Burger '974, since Burger '974 state at col. 32, lines 30+ that such a modification would provide a stable, monolithic structure for easy integration into a system to improve the image quality or modulation transfer function thereof.

Regarding claim 21, the combination of Mann '793 and Burger '974 discloses wherein the mask is made of a nonlinear optical material (i.e., see col. 33, lines 1-16 of Burger '974).

16. Claims 45, 46, 47 and 52 rejected under 35 U.S.C. 103(a) as being unpatentable over Mann '793 in view of Laroche et al. (U.S. 5,373,322).

Regarding claim 45, it is noted that although Mann '793 shows the step of exposing the image sensor (col. 2, lines 40+) using spatially varying exposure and step of normalizing the pixel values provided by the image sensor including the step of mapping the pixel values by a function of the exposure values to derive corresponding normalized pixel values (i.e., Figs. 1-4 and 7A; col. 7, lines 20-col. 8, lines 10+), Mann '793 does not explicitly show the step of using "a mask having a multiplicity of light transmitting cells each controlling the exposure of a respective one or more of the light-sensing elements of the image sensor to light from the scene, each of the light-sensing element having a corresponding exposure value indicative of the

transparency of the mask cell through which light impinging on the light-sensing element passes" as recited in the present claimed invention.

However, the above-mentioned claimed limitations are well known in the art as evidenced by Laroche '322. In particular, Laroche '322 discloses the use of a mask (i.e., see Fig. 1, noted the color filter mask 13 having a respective light transmitting cells each controlling the exposure of the respective color signals for the light-sensing sensor 12) and the mask having a multiplicity of light transmitting cells each controlling the exposure of a respective one or more of the light-sensing elements (i.e., noted from Figs. 1 and 3 that each cell of the mask 13 is capable of controlling the exposure of a respective one of the sensor)of the image sensor to light from the scene, each of the light-sensing element having a corresponding exposure value indicative of the transparency of the mask cell through which light impinging on the light-sensing element passes (col. 3, lines 1-68)" as recited in the present claimed invention.

In view of the above, having the system of Mann '793 and then given the well-established teaching of Laroche '322, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system of Mann '793 as taught by Laroche '322, since Laroche '322 state at col. 1, lines 65+ that such a modification would reduce color edge artifacts and improve image sharpness, without unduly increasing cost and complexity thereof.

Regarding claim 46, the combination of Mann '793 and Laroche '322 discloses wherein the step of mapping the pixel values by a function of the exposure values comprises dividing each of the pixel values with the exposure value corresponding to the light-sensing element receiving light intensity represented by the pixel values (i.e., see col. 7, line 45-col. 8, lines 15+ of Mann '793; and col. 6, lines 30-35+ of Laroche '322).

Regarding claim 47, the combination of Mann '793 and Laroche '322 discloses wherein the exposure values corresponding to the light-sensing elements are fixed (i.e., noted that the exposure values of the image sensor are normally fixed to the specific pixel values and this can be seen in Figs. 2 and 7B of Mann '793; also it is cleared that the exposure values of the image sensor 12 is fixed to a specific color values as shown in Fig. 1 and 3 of Laroche '322), and further comprising the step of interpolating the normalized pixel values to derive interpolated pixel values at respective position of a second array overlapping the array of the light-sensing elements (i.e., as shown in Figs. 7B of Mann '793 that during the calibration process, the normalized pixel values of the first and second array of differently exposed pixel values presented by the response curves are interpolated to determined the target pixel values thereof; see col. 8, lines 10+, col. 10, lines 10+ and col. 11, lines 10+ of Mann '793).

Regarding claim 52, the combination of Mann '793 and Laroche '322 discloses the step of storing the interpolated pixel values in an output image memory (i.e., noted form Fig. 8 of Mann '793 that the interpolated pixel values may be stored in the memory devices 250 and 208 respectively).

Allowable Subject Matter

17. Claims 5-6, 8-12 (noted to correct the 112 problems in claims 9 and 12), 13, and 37-42 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

18. Claims 4 and 49-50 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

Conclusion

19. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

a. Fang '408, Lieberman '671 and Ikeda '773 shows an imaging system having different exposed images and normalizing the lighting changes in the input image thereof.

20. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Aung S. Moe whose telephone number is 703-306-3021. The examiner can normally be reached on Mon-Fri (9-5).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wendy Garber can be reached on 703-305-4929. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9306 for regular communications and 703-872-9306 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-9700.

Aung S. Moe
Primary Examiner
Art Unit 2612

A. Moe
October 17, 2003